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Getscher

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[54] **INTRAMEDULLARY HIP PIN**

[76] Inventor: **Philip E. Getscher,** 2700 Eastgate St., Lincoln, Nebr. 68502

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[51] **Int. Cl.**[2] **A61F 5/04**

[58] **Field of Search** 128/92, 83; 3/1

[56] **References Cited**

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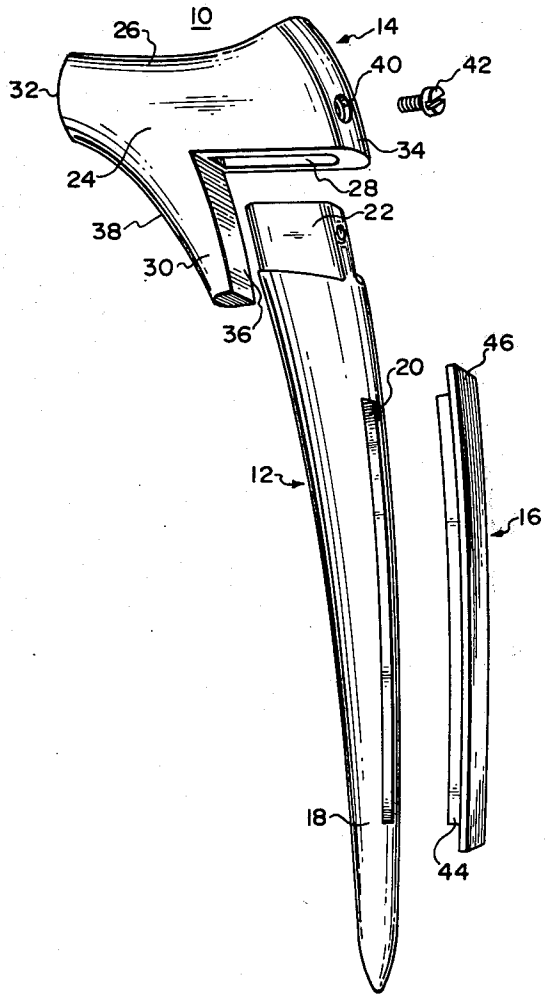
Primary Examiner—Robert W. Michell
Assistant Examiner—J. Yasko
Attorney, Agent, or Firm—Vincent L. Carney

[57] **ABSTRACT**

To receive the weight of the body from the pelvis and distribute it evenly to the shaft of a fractured femur while bracing the fractured femur, an intramedullary hip pin includes a head and a shank with the head including in its bottom surface a groove which receives a tongue from the top of the shank and is held thereto by a set screw. The head of the hip pin has a concave-downward saddle portion positionable beneath the neck of the femur to receive and distribute forces from the pelvis and has a blunt nose to impede its protrusion through the head of the femur. The shank extends downwardly within the shaft of the femur, being wedged therein by a shim plate.

10 Claims, 4 Drawing Figures



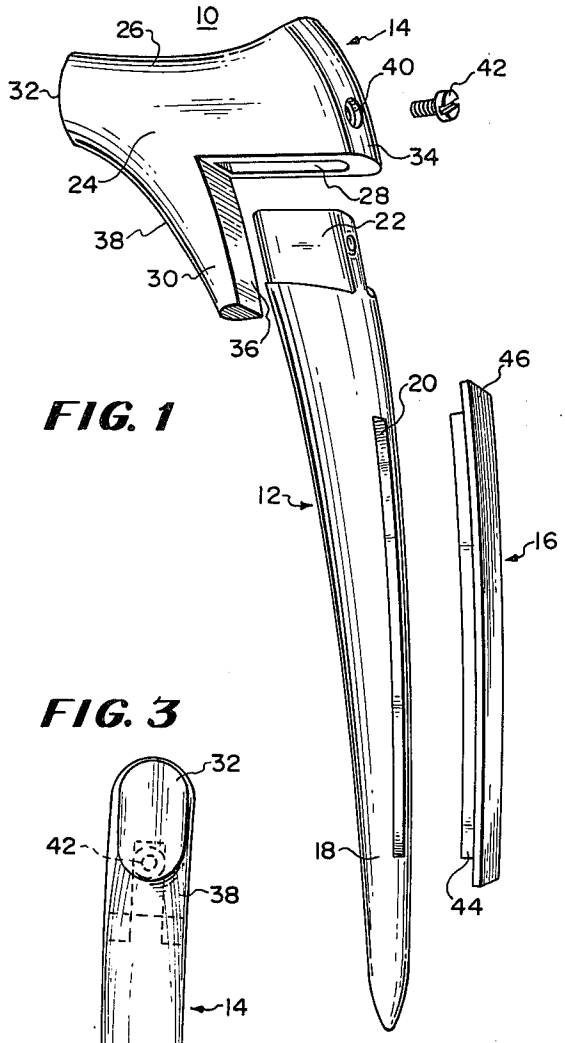


FIG. 1

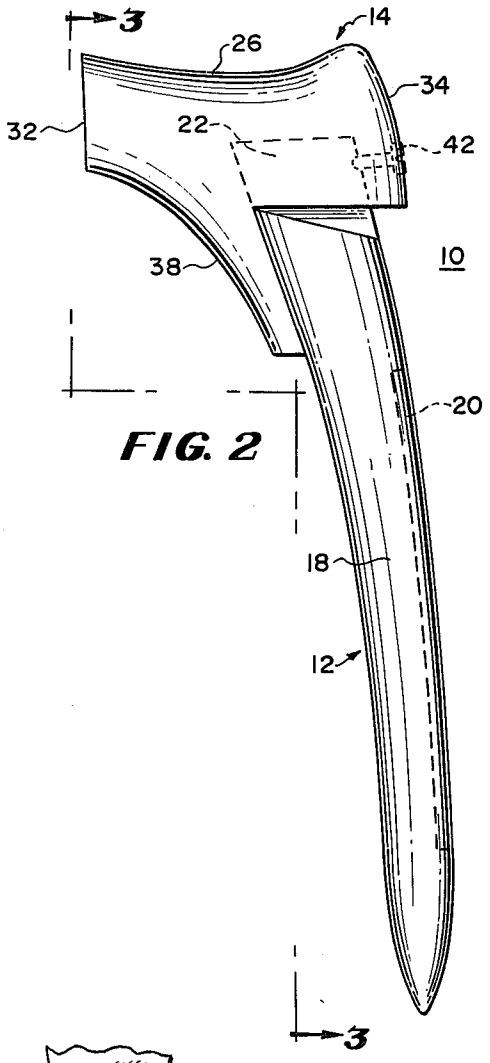
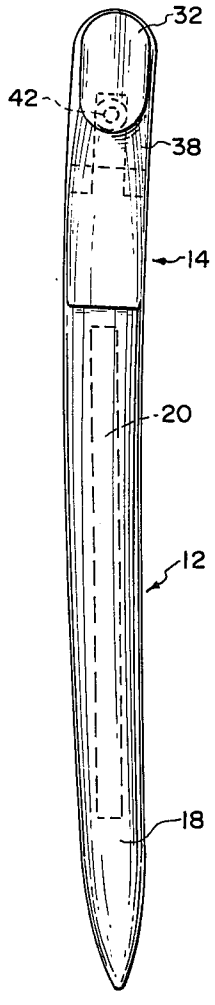


FIG. 2

FIG. 3



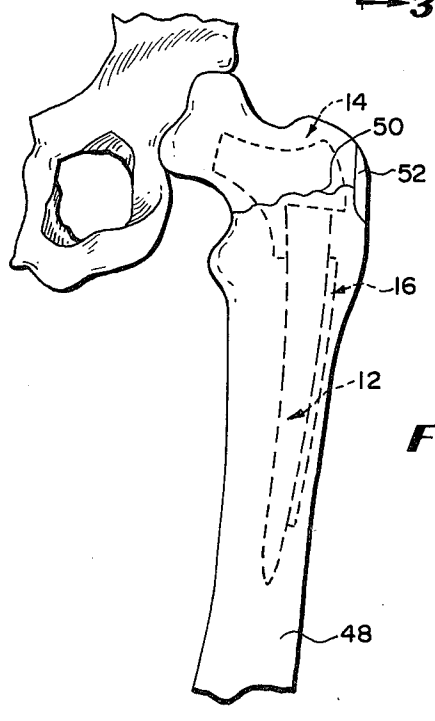


FIG. 4

INTRAMEDULLARY HIP PIN

This invention relates to hip pins.

One class of hip pin includes a head portion that is anchored within the head and neck of the femur and a shank portion in the shaft of the femur to brace the femur across the fracture with the head and shank portions being fastened together. In a prior art type of this class of hip pin, the head of the hip pin is a narrow cone which extends through the neck of the femur on one end to a location adjacent to the head and extends from the other end of the femur, with the shank extending along the femur and being fastened thereto on the outside. The prior art type of hip pin has several disadvantages such as: (1) the head and neck of the femur tend to be forced down by the weight of the pelvis causing the head of the hip pin to be forced through the head of the femur into the hip joint; (2) the forces are poorly distributed from the pelvis onto the femur and require a relatively strong and large hip pin; and (3) weight cannot be placed on the fractured femur for an excessive period of time after the hip pin is implanted.

Accordingly, it is an object of the invention to provide a novel hip pin.

It is a further object of the invention to provide an intramedullary hip pin.

It is a still further object of the invention to provide a hip pin in which the forces from the pelvis are distributed along the center of the shaft of the femur through the shank of the hip pin.

It is a still further object of the invention to provide a hip pin which resists being forced through the head of the femur.

It is a still further object of the invention to provide a hip pin which includes a saddle that receives forces from the neck of the femur.

In accordance with the above and further objects of the invention, an intramedullary hip pin includes a head portion, a shank portion and a shim plate which fit together to hold the head and neck of the femur above the fractured portion to the shaft of the femur below the fractured portion.

The shank of the intramedullary hip pin is shaped to fit along the medulla of the femur shaft, being formed substantially like a cone which is bent and having its pointed end downward, the upper end including a tongue which mates with a groove in the head portion, being held thereto by a set screw. The shim plate is wedged between the wall of the femur shaft and the shank of the hip pin, mating with the hip pin with a tongue and groove connection to prevent rubbing of the shank of the hip pin against the wall of the femur.

The upper portion of the head has a saddle which corresponds substantially in shape to the neck of the femur so as to receive forces from the pelvis and distribute them relatively evenly along the shank of the hip pin downwardly through the medulla of the shaft of the femur. The head also includes a blunt nose facing the hip joint which resists movement of the head of the hip pin through the head of the femur and a downwardly extending brace that fits along the shank when the hip pin is assembled.

To insert the hip pin, holes are cut in the wall of the femur and portions of the head and shaft of the medulla of the femur are reamed to accommodate the hip pin. The shank of the hip pin is then inserted with its point entering first, the center of the curve of the hip pin being outwardly until the shank is inserted. The shank is then turned around so that the outer portion of its curvature faces the lateral wall of the femur.

After the shank of the hip pin has been inserted, the head is inserted with the brace of the head being inserted first, then the outer end and finally the nose, after which it is turned around so that the nose faces the hip joint and the bottom groove receives a tongue on the upper portion of the shank. A set screw then holds the shank to the head. In this position, the saddle of the head rests beneath the concave neck of the femur to receive forces from the pelvis and distribute them through the shank along the medulla of the femur shaft.

Because the weight from the pelvis is distributed from the neck of the femur to the saddle on the head of the hip pin, from the head of the hip pin to its shank and from the shank to the medulla of the femur shaft, the hip pin of this invention has several advantages, such as: (1) there is no strong tendency for the head of the femur to be shifted downwardly with respect to the pelvis; (2) the nose of the femur does not tend to move through the head of the femur; (3) a relatively small hip pin is sufficient to brace a fractured femur; and (4) the fractured femur can bear weight in a relatively short time after implanting of the hip pin.

The above noted and other features of the invention will be better understood from the following detailed description when considered with reference to the accompanying drawings in which:

FIG. 1 is an exploded perspective view of a hip pin in accordance with an embodiment of the invention;

FIG. 2 is an elevational side view of the hip pin of FIG. 1;

FIG. 3 is an elevational rear view of the hip pin of FIG. 1; and

FIG. 4 is a fragmentary perspective view of a portion of a pelvis and fractured femur held together by a hip pin in accordance with an embodiment of the invention.

In FIGS. 1–3, there is shown an intramedullary hip pin **10** having a shank portion **12**, a head portion **14** and a shim plate **16**, with the head portion **14** and shim plate **16** being shaped to mate with the shank **12** when assembled within a femur of a subject to hold the fractured portions of the femur together.

To provide an intramedullary anchor within the portion of the femur below the fractured section, the shank portion **12** includes a body section **18** having a general shape of a cone bent in a slight arc and flattened slightly on two opposite sides so as to fit within a reamed opening in the medulla of the femur with the outer side of the arc facing the lateral side of the femur and the flattened sides facing the anterior and posterior sides of the femur. The outer side of the body portion **18** has a longitudinally extending groove **20** along a portion of its length to mate with a tongue **44** extending from the shim plate **16** as will be explained hereinafter.

To mount the body portion **18** to the head portion **14**, a tongue **22** is formed in the upper end of the body portion **18** to be received within a corresponding groove in the head **14**.

While the body portion **18** in the preferred embodiment resembles a cone inverted and bent outwardly, its shape and size is adapted to the center of a femur and is of a size suitable for a particular femur. In practice, several different sizes of body portions **18** are available for selection to fit the particular size femur into which it is to be inserted. A typical hip pin is approximately

six inches long from the bottom of the saddle to the bottom of the shank, with the saddle being 2 inches long and one-quarter of an inch deep. The shank has curved walls with an approximately elliptical cross section at the tip and is substantially cone shaped at the bottom where it forms a rounded point. The top has a major axis of approximately five-eighths of an inch and a minor axis of approximately one-half inch. The shank is curved lengthwise, having approximately a 6 inch radius of curvature and bends inwardly about three-eights of an inch.

To form a connecting anchor within the neck of the femur and the femur shaft of the upper side of the fracture, the head portion **14** includes a body **24** having on its top surface a saddle **26** and on its bottom surface a horizontal longitudinal groove **28** bounded by a downwardly extending brace **20,** with the inner end of the body **24** ending in a blunt nose **32,** which faces the pelvis when inserted, and the outer end having a flat supporting surface **34** facing the lateral side of the femur.

The groove **28** is of sufficient size to tightly receive the tongue **22** on the top of the shank **12** and the downwardly extending brace **20** has a surface **36** shaped to abut the inner side of the tongue **22** and body portion **12.** The flat supporting surface **34** includes a tapped hole **40** adapted to receive a set screw **42** for fastening the tongue **22** within the groove **28,** with the tapped hole **40** including a counterbore on its outer surface adapted to receive the head of the set screw **42.**

To support the weight of the body, the saddle **26** has a downward curved surface which conforms substantially to the outer surface of the neck of the femur thus enabling it to bear the weight of the body and direct that weight downwardly through the medulla of the femur shank **12.** The blunt nose **32** on the inner end on the head **14** is shaped to prevent it from extending through the head of the femur and a curved surface **38** extends from the lower end of the blunt nose **32** to the bottom end of the brace **30** to form an additional supporting surface against the head of the femur.

The shim plate **16** is a generally flat plate having a tongue **44** extending longitudinally from one flat surface of such a size as to fit within the groove **20** in the body portion **18** of the shank **12** to prevent sliding motion between the shank **12** and the shim plate **16.** The flat shim plate **16** is inserted between the forward surface of the body portion **18** of the shank **12** and the bone wall to prevent movement of the body portion **18** within the center of the femur, with the flat plate **46** being shaped to fit against the femur wall.

In FIG. **4,** there is shown an intramedullary hip pin **10** positioned within a femur **48** having a fracture **50** with the head **14** of the pin being positioned within the neck of the femur, the shim **16** being positioned along the lateral left side of the femur and the outwardly curved side of the shank **12** being inwardly of and mating with the shim plate **16.**

To insert the intramedullary hip pin an opening **52** is prepared in the lateral side of the femur near a fracture **50** by drilling two holes which overlap along the length of the femur. The neck of the femur and the upper portion of the shaft of the femur are then reamed to accommodate respectively the head **14** and the shank **12** of the intramedullary hip pin **10.**

After the femur has been reamed, the shank **12** is inserted into the hole **52,** with its pointed end going in first and the remainder following, its convex outer side facing the opening and its concave side facing laterally as it enters. In this position, the shank **12** is moved downwardly into the femur and then turned so that its convex outer side faces laterally or in the opposite direction from which it entered.

After the shank **12** is implanted, the head **14** is inserted through the same hole **52** and moved above the fracture. The head is inserted with its downwardly extending brace **30** entering first and its supporting surface **32** entering next so that its blunt nose **32** points outwardly or laterally. It is then turned around within the opening so that the blunt nose **32** faces upwardly into the head of the femur. With both the shank **12** and the head **14** within the femur, the tongue **22** is forced within the groove **28** with the brace **30** abutting one surface of the tongue **22.** The set screw **42** is then threaded into the tapped hole **40** until its head is within the counterbore to hold the tongue **22** within the groove **28.**

After the head **14** and shank **12** are within the femur, the shim plate **16** is inserted with its tongue **44** aligned with the groove **20** in the body portion **18** of the shank **12.** It is moved downwardly to separate the body portion **18** of the shank **12** from the wall of the femur and wedge it in place to prevent excessive friction against the bone wall. The groove **14** aids in holding the shank **18** in place.

With the intramedullary hip pin in place, the weight of the pelvis and body is upon the saddle **26** and imparted to the shank **12** which is along the medulla of the femur shaft. There is no tendency for the blunt nose **32** to be forced through the head of the femur since the weight is moved directly downward. Moreover, greater support is provided by the same size material because of the central location of the pin and the fractured femur can bear weight in a relatively short period of time after the hip pin is implanted.

Although a preferred embodiment has been described with some particularity, many modifications and variations in the invention are possible within the light of the above teachings. It is therefore to be understood that, within the scope of the appended claims, the invention may be practiced other than as specifically described.

What is claimed is:

1. An intramedullary hip pin for supporting a fractured femur comprising:

a head portion shaped to fit within the neck of the femur;

an elongated shank portion adapted to fit within the medulla of the femur shaft;

said head portion having a concave saddle portion having a curved surface substantially conforming to the curvature of the neck of the femur; and a blunt-nose surface substantially orthogonal to the saddle portion whereby said blunt-nose surface resists penetrating the head of the femur;

and coupling means for removably coupling while within said femur said head portion and shank portion in orthogonal relationship, with said shank portion extending from the head portion in the same direction as the concave portion of said saddle, whereby said shank extends downwardly through the medulla of a femur shaft and the head portion is beneath the neck of the femur so that the saddle receives forces from the pelvis and distributes these forces through the shank along the medulla along the femur shaft while bracing the fractured portions of the femur.

2. An intramedullary hip pin according to claim 1 in which said head portion includes a blunt nose surface substantially orthogonal to said saddle, whereby said blunt nose surface resists penetrating the head of the femur.

3. An intramedullary hip pin according to claim 2 in which said shank portion has a longitudinal axis and exterior walls, said exterior walls being curved around the longitudinal axis with the lower end of the shank portion being of smaller diameter than the upper end of the shank portion so as to conform smoothly to a reamed out portion of the femur.

4. An intramedullary hip pin according to claim 3 in which said coupling means includes a groove in one of said head and shank portions and a tongue in the other of said head and shank portions.

5. An intramedullary hip pin according to claim 4 in which said coupling means further includes a set screw and a tapped hole adapted to connect said tongue to said other member.

6. An intramedullary hip pin according to claim 5 in which said coupling means further includes a brace extending downwardly from and being integrally formed with said head portion, said brace being adjacent to said shank portion.

7. An intramedullary hip pin according to claim 6 in which said pin comprises stainless steel.

8. An intramedullary hip pin for supporting a fractured femur comprising:

a head portion;

an elongated shank portion adapted to fit within the medulla of the femur shaft;

said head portion having a concave saddle portion having a curved surface substantially comforming to the curvature of the neck of the femur;

coupling means for removably coupling said head portion and shank portion in orthogonal relationship, with said shank portion extending from the head portion in the same direction as the concave portion of said saddle, whereby said shank extends downwardly through the medulla of a femur shaft and the head portion is beneath the neck of the femur so that the saddle receives forces from the pelvis and distributes these forces through the shank along the medulla of the femur shaft while bracing the fractured portions of the femur;

said head portion including a blunt-nose surface substantially orthogonal to the saddle whereby said blunt-nose surface resists penetrating the head of the femur;

said head portion including first and second side walls substantially parallel to each other and connecting said saddle portion and, a first end wall orthogonal to said first and second side walls and connecting said saddle portion and each of said first and second side walls;

said blunt nose surface forming a second end wall separated from said first end wall by said first and second side walls and said saddle;

said second end wall extending substantially in the same direction as said first end wall;

said head portion further including a bottom wall;

said bottom wall being separated from said saddle portion by certain of said side and end walls;

said bottom wall including a portion of said coupling means.

9. An intramedullary hip pin according to claim 8 in which said coupling means includes a groove in said bottom wall and a brace extending from said bottom wall adjacent to said groove.

10. An intramedullary hip pin according to claim 9 in which said coupling means includes:

a tongue on said shank adapted to fit within said groove;

said first end wall including internal walls defining a tapped hole adapted to receive a set screw.

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